

Biomarker Response to Galactic Cosmic Ray-Induced NO_x and the Methane Greenhouse Effect in the Atmosphere of an Earthlike Planet Orbiting an M-Dwarf Star

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Planets orbiting in the habitable zone (HZ) of M-Dwarf stars are subject to high levels of cosmic rays which produce nitrogen oxides in earthlike atmospheres. We investigate to what extent this NO_x may perturb biomarker signals. Our model results suggest that the biomarker signals are robust, changing in the M-star atmospheric column by up to 25% due to the GCR NO_x effects compared to an M-star run without GCR effects and can therefore survive at least the effects of galactic cosmic rays. We have not however investigated stellar cosmic rays here. Methane (CH₄) levels are about x1000 times higher than on the Earth related to a lowering in hydroxyl (OH) in response to changes in UV, as already noted in previous studies. The high CH₄ levels produce a large greenhouse effect of 50-60K which has a potentially large effect upon the biomarker columns.